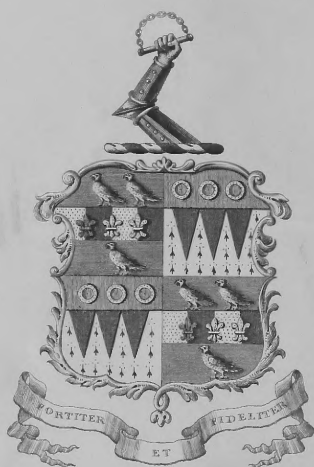


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DR. RONALD B. MADGE
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INSTRUCTIONS
FOR
COLLECTING AND PRESERVING
VARIOUS SUBJECTS OF
NATURAL HISTORY;

AS

ANIMALS, BIRDS, REPTILES, SHELLS, CORALS, PLANTS, &c.

TOGETHER WITH A

T R E A T I S E

ON THE

Management of INSECTS in their several States ;

SELECTED FROM THE BEST AUTHORITIES.

By E. DONOVAN,

AUTHOR OF THE NATURAL HISTORIES, OF BRITISH BIRDS, AND INSECTS.

L O N D O N :

Printed for the AUTHOR ; and sold by Messrs. RIVINGTONS, St. Paul's
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1794.

P R E F A C E.

AS the instructions which are included in the following sheets, promise to be of most utility to the unexperienced collector in the form of pocket assistant, to which he may occasionally resort for information, we have endeavoured to divest them of whatever appeared in the smallest degree superfluous to that design; at the same time that we were careful to avoid unnecessary brevity, or passing silently over those particulars which required to be placed in a perspicuous point of view.

We have to observe as an apology for its publication, that the treatise on the management of insects, and the instructions for the preservation of birds, appear at the express request of many subscribers to our Natural Histories, and that we have only exceeded their solicitations by adding what relates to the preservation of animals, shells, corals, and other natural productions; such addition appearing to us likely to render the volume more acceptable to the early naturalist, whose enquiries are not confined to the study of birds, or the science of entomology.

With respect to the practical part of those instructions, it will not be expected that the natural attitude of an animal, a bird, or an insect, can be given so well by an unskilful operator as by a professional man, who is in constant practice, it must rather be inferred that by due attention to the information we have given, he may ensure their preservation from the ravages of those destructive mites, and the larvæ of minute beetles or moths which breed among the feathers of birds, the hair of animals, or down of insects, and would destroy them in the course of a few summer months, unless prevented by timely precautions.

Although

P R E F A C E.

Although we have found it necessary to treat of insects in a more extensive manner than of any other subject in the work, we have principally confined our attention to the practical part, without entering into any particulars relative to their scientific arrangement in the cabinet; for however such a digression might assist the student, it would not only be foreign to our design, but render the whole too voluminous and expensive for general accomodation.

A practical and scientific knowledge of insects, are so intimately connected with each other, that a competent knowledge of the former must be combined with the latter, before any considerable proficiency can be acquired; the inexperienced entomologist must not rest satisfied with the preserved specimens in his cabinet, he must attend carefully to their manners, peculiar positions, and many other circumstances in a living state, before he can attempt to ascertain the species, or even genus of many kinds.

Many other advantages will result to persons of that description, from a minute observance of insects in a living state, but as we care not to expatiate on what may be already known to them, we shall conclude with observing, that as every person, who may feel an inclination to appropriate a few of his leisure hours to the study of entomology, cannot have an opportunity to procure the necessary instructions, and those especially whose business, or concerns, require their residence in a distant part of the country, we conceive that the present treatise will not be unacceptable; we submit it to the candid perusal of those, whose exertions in practical entomology it is most likely to assist, but trust that among the variety of other instructions which are concentrated from the best authorities, at least some will be found useful to every class of natural history collectors.

INSTRUCTIONS

FOR

COLLECTING AND PRESERVING

VARIOUS SUBJECTS OF

NATURAL HISTORY.

THE PRESERVATION OF ANIMALS AND BIRDS.

ALTHOUGH Quadrupedes constitute one of the most important divisions of Natural History, we have scarcely any collection in this country that includes more than a very partial selection of the smallest kinds ; indeed the many unfurmountable difficulties which would offer to a collector in this department, independent of an immense expence, will ever deter the most affluent, from an attempt that must be ultimately unsuccessful.

Collections of Birds are more frequent both in the living and preserved state ; they are more engaging in appearance, and require less expence and trouble.

The following rules may be useful to the curious traveller, if he has any desire to preserve some of the rare specimens either of

Animals or Birds that he may meet with in foreign countries; and should he even want experience enough to give them their proper attitudes, he may preserve them free from injury, and transmit them from one part of the world to another without any apprehension of depredation by Insects.

Precautions to be observed.

Provide a quantity of allum, arsenic, camphire, sulphur, and warm spices; tobacco, tanners bark, bitter aloes, and spirit of wine; some cotton, wool, fine tow, and oakum.

ANIMALS

MUST be entirely divested of the flesh; first open the skin with a pair of sharp-pointed scissars, in a strait direction from the vent to the throat, and take away all the inside, scoop out the brains, take away the eyes, and with the scissars cut off whatever flesh you can from within the head, as the tongue, &c., but leave the skull; during this operation be careful to preserve the mouth, snout, feet, and claws perfect, and if any blood, or slimy matter adheres to the hair, wash it off with a sponge and warm water: the skin must then be laid on a flat board, or table, and rubbed on the inside with some composition liquor, or powder, until it feels perfectly dry under the hand. The liquor is thus prepared:

Dissolve some camphire in a quantity of spirit of wine, and thereto add a proportion of burnt-allum and sulphur; to one ounce of the camphire that is dissolved in the spirit of wine, put

Half a pound of burnt-allum, and

One ounce of sulphur.

Or of Tanners bark well dried and powdered two parts,
 Tobacco highly dried one part, and
 Burnt-allum one part ; first bake the allum to a cake
 on a shovel, and reduce it to a fine powder.

Add to every pound of those ingredients, One ounce of arsenic,
 Ditto camphire,
 Half an ounce of sulphur.

Either of those compositions may be prepared at leisure, and kept
 always fit for use, if the bottles in which they are preserved are
 well corked.

Colonel Davies advifes, to prepare the mixture with a double pro-
 portion of burnt-allum, and to add one ounce of bitter aloes.

Introduce a strong wire frame to assist in giving the attitude, or
 to support the animal in a standing position ; then stuff the skin
 either with tow, wool, or cotton, according to the size of the Ani-
 mal, but be very cautious not to distend the skin in any part so as
 to give it an unnatural appearance : it will be better to measure the
 exact proportion of every part before you take off the skin.

The eyes are made of glass, and may be purchased at the glass-
 bead manufactories, of any size or colour ; black are those which
 suit most subjects, but if it should be necessary to have only a black,
 or dark speck in the centre of a white bead, it can be blown with a
 pipe to a proper size on the bead, or painted with oil colour ; how-
 ever, to prevent obstacles, it will be most advisable for travellers to
 purchase a complete assortment.—*Note.* Open the eye-lids very wide,
 and introduce the bead into the socket, the bead must be some-

what larger than the true eye, that it may fill up the space ; then draw together the eye-lids and adjust them so as to leave a proper opening.

For convenience, the Animal may be transported from the *Indies*, or any distant part of the world, and the intended attitude may be given after it has arrived, only be careful to pack it up in a close box with a quantity of tobacco and camphire.

But the best and most expeditious method, if the size of the Animal will permit, is to plunge it into a bottle or barrel of spirits ; in this manner it will retain the size and proportions infinitely better, than what the utmost skill of man can imitate, by any attempt to stuff the skins only. *Observe* to cover the mouths of the bottles with tin foil, or with a composition of melted resin and borax.

Experiments have been made to preserve the skins of Animals, with part of their flesh and bones within, so as to give the exact dimensions of the living creature ; for this purpose they are opened as before described, the entrails taken out, with all the flesh that can conveniently be cut away ; the brains, eyes, tongue, &c. ; also cut off the flesh on the sides of the ribs as low as possible and scrape the bones, then rub the skin well with the preparing powder, and fill up every vacant part with the same composition, of burnt-allum, tanners bark, &c. as before described ; but add some wool and cotton, or tow, which has been steeped in spirit of wine and camphire ; then sew up the opening. It must after this preparation be baked in a slack oven, but the heat must be so exactly tempered as not to scorch the hair.

BIRDS.

THE different methods of preserving Birds perfectly agree in most respects with those for the preservation of Animals ; only as they are generally smaller, they are more difficult to prepare, and a greater number of instruments will be required.

Provide a quantity of different sized wires, if nealed it will be best ; a variety of coloured glafs beads, those which are black may have artificial irides painted on them, and will suit many subjects ; a blunt pen will do very well to take away the brains with, if the Bird is small ; but large specimens will require a small scoop ; a pair of nippers, to assist in taking out the entrails ; wire clippers, small awls, small files, knives, scissars, &c.

Open the Bird along the breast, (if necessary from the vent to the throat) and separate the skin on each side from the flesh, take out the entrails, &c. ; then proceed to cut out the flesh, and so much of the bones as you can conveniently ; or it will be better to take off the skin, and only leave the bones of the head and thighs ; scoop out the brains, eyes, tongue, roof of the mouth, &c. and strew the skin with preserving powder ; introduce two stout wires (according to the size of the Bird), which have been sharpened at their points, through the soles of the feet, up the legs, and close to the breast ; leave an inch or more without the feet, when you cut off the wires : at the ends which reach the breast the wires are interwoven with three others, one whereof passes up the neck, and through the head and nostril, where it must be cut off, or filed smooth ; the others pass one
into

into each wing : two more are united to those in their descent, and are passed into the tail. Thus prepared the inside must be strewed with the preserving powder, and filled with fine dry tow, or cotton, (and some moss if convenient.) *Observe*, that if the stuffing has been before steeped in spirit of wine, it will be better ; and you may put a quantity of musk, or camphire, into the body with the tow.

Begin at the vent with your needle and silk, and as you sew up the skin add as much stuffing as the skin will bear without tearing ; pass your needle from the inside outwards, which will prevent the feathers being in the way. When you have entirely closed the opening lay the feathers smooth on the breast, so as to conceal the sewing ; then introduce the eyes into the sockets. The two pieces of wire which are left through the soles of the feet are intended to fix it in the case ; if you mean to have it perched on a stump, or branch, you are to make a hole through the wood, and pass those wires through. The Birds must be baked in a slack oven until all the moisture is exhaled ; the proper degree of heat may be known by putting a feather into the oven ; if it is scorched, or curled up, the heat is too great.

PLATE I. FIG. 1.

To assist the description we have added a Plate of the wire frame, used in stuffing a small specimen of the Bittern, or Heron tribe ; most other kinds may have the wire frame constructed in a similar manner.

Observe, that the crevices in the cases which are to receive the Birds, are to be stopped up with *plaster of Paris*, so as to entirely exclude all external air ; and when the fronts are glazed, do not omit to put a quantity of camphire into each case, as that alone will greatly
con-



contribute to destroy the insects which always breed in the feathers of stuffed Birds. If at any time you discover fragments of feathers at the bottom of the case, it is a sign of the depredations of insects, and do not delay to open the case, and burn a quantity of sulphur in it for an hour or more ; this will in most circumstances destroy the insects until the following season, and no way injure the Bird ; but should it prove insufficient, bake them as before, and the larvæ of the insects will be inevitably destroyed.

Birds are sometimes preserved in spirits, during a voyage ; in this case, it is proper to wrap each subject up in a piece of fine linen, to prevent their receiving any injury, either by rubbing against one another, or the sides of the vessels which contain them.

The legs of many Birds fade immediately after death, the beak is liable to the same change ; and some have caruncles, or fleshy protuberances, which also lose colour, as the neck of the Cassowary, wattles of the Cock, neck of the Golden Vulture, &c. all those defects must be remedied by painting the parts, as near as possible to the natural hue, with oil colours.

The natives of the *Papau Islands*, it is reported, have a peculiar method of preserving the skins of the lesser Birds of Paradise ; they take out the entrails, sear their insides with a red-hot iron, and put them into hollow pieces of *bamboo*. Similar practices on Birds of this, or other countries, will perhaps render it very necessary, when stuffed specimens are received, to examine whether a quantity of the flesh is contained within the skin, and if such flesh has not been properly prepared, it should be immediately cleared away ; for this purpose wrap the Bird in a wet cloth, and let it remain

therein for two or three hours ; it will be so much relaxed by this treatment that it may be opened and the flesh taken away.

It may be also relaxed by holding it a few minutes over the steam of boiling water, or by being put into the earth and covered over for a few hours. It is a practice with seamen to stuff the skins of Animals and Birds with saw-dust, which answers very well for their preservation during a voyage, but if permitted to remain within the skin for any considerable time after, it may serve as a *nidus* for Insects, which, being hatched, will entirely devour the skin and feathers, or hair.

If you wish to preserve the nest and eggs, it will only be necessary to blow out the contents of the eggs, and fasten them into the nest with gum or glue.

REPTILES, FISHES, &c.

VERY little preparation is necessary for any of the subjects which fall under this head, they are best preserved in spirit of wine, and only require to be washed clean from all slimy matter before they are put into the bottles.

Some species of Reptiles, and a few of Fishes, may be preserved by opening them, and taking out all the inside, then being strewed with the preserving powder, and filled with tow; after which they should be covered with two or three coats of copal varnish.

The exuvix of Serpents may be stuffed and varnished in this manner.

If you wish to preserve the skeletons of small Reptiles, suffocate and put them into an Ant's nest; in a few hours they will devour the flesh and leave the skeleton entire. We have the skeletons of some very small species which were received from *China*, they were prepared in this manner, and although several among them scarcely exceed half an inch in length, all the bones are properly disposed and perfectly clean.

A

TREATISE

ON THE

MANAGEMENT OF INSECTS.

TREATISE

ON THE

MANAGEMENT OF INSECTS.

INSECTS are distinguished from other Animals by the wonderful changes that all, except those of the seventh class (aptera *), pass through.

Antient writers were not acquainted with the transformations of Insects, as appears very plainly by the erroneous suppositions generally entertained ; neither was the mystery entirely explained till the latter end of the last century, when *Malpighi* and *Swammerdam* made observations and experiments on Insects, under every appearance, and by dissecting them just preceding their changes, were enabled to prove, that the Moth and Butterfly grow and strengthen themselves, and that their members are formed and unfolded, under the figure of the Insect we call Caterpillar,

* Apterous Insects are those without wings, as the Tick, Spiders, Crabs, the Wood-louse, *Scolopendræ*, &c,

The succession of its transformations are, the Larva or Caterpillar is hatched from the egg.

From the larva it passes into the Pupa, or Chrysalis state.

From the Pupa or Chrysalis, into the Imago or Fly state.

THE EGG.

THE eggs of an Insect are always small, compared with the size of the Insect itself; they vary in number and figure in different species; some are round, others oval; some are cylindrical, and others nearly square; the shells of some are hard and smooth, while others are soft and flexible. It is a rule, but is not invariable, that the eggs never encrease in size after they are laid.

They are found of almost every shade of colour, and are always disposed in those situations where the young brood may find a convenient supply of proper food; some Insects deposit their eggs in the oak-leaf, producing there the red gall; others cause a similar appearance on the poplar-leaf, and the red protuberances on the willow-leaf, and the termination of the juniper branches are produced by like means: the leaves of some plants are drawn into a globular head by the eggs of an Insect lodged therein; and many curious circumstances relative to this œconomy might be noticed if the nature of our plan would permit.

The Phryganea, Libellula, Gnat, Ephemera, &c. hover all day over the water to deposit their eggs, which are hatched in the water, and remain there all the time they are in the larva form. Many Moths cover their eggs with a thick bed of hair which they gather from their bodies, and others cover them with a glutinous composition, which, when dry, protects them from moisture, rain, and cold; and the Wolf-Spider carefully preserves its eggs in a silk bag, which it carries on its back: by some Moths they are glued with great symmetry round the smaller branches of trees, or are secreted beneath the bark, and frequently in the crevices of walls, in hollow stalks, &c.

THE CATERPILLAR.

ALL Caterpillars are hatched from the egg, and when they first proceed from it are small and feeble, but their strength increases in proportion with their size; a distinguishing character of the Caterpillar of a Lepidopterous Insect is not having less than eight, or more than sixteen feet.

The Caterpillar, whose life is one continued succession of changes, moults its skin several times before it attains its full growth; those changes are the more singular as it is not simply the skin which is cast off; but with the *exuviae* we find the skull, the jaws, and all the exterior parts, both scaly and membranaceous, which compose the lips, antennæ, palpi, and even those crustaceous pieces within the head, which serve as a fixed basis to a number of muscles, &c.

The new organs are under the old ones, as in a sheath, so that the Caterpillar effects its change by withdrawing from the old skin when it finds it inadequate to its bulk.

Those Caterpillars who live in society, and have a nest, retire there to cast their *exuviae*; fixing the hooks of their feet firmly in the web during the operation. Some of the solitary species spin at this time a slender web, to which they affix themselves. A day or two before the critical moment for its moulting, the Insect ceases to eat, and loses its usual activity, the colours gradually become weaker and the Caterpillar more feeble, the skin hardens and withers, the
creature

creature lifts up its back, stretches itself to the utmost extent, sometimes elevates its head, moving it a little from one side to another, and suddenly letting it fall again; near the change, the second and third rings are seen to swell considerably; and by repeated exertions a slit is made on the back, generally beginning on the second or third ring: through this division the new skin may be just perceived by the brightness of its colours; the creature presses through like a wedge, and thereby separates the skin from the first to the fourth ring, which sufficiently enlarges the aperture to admit the Caterpillar through.

The Caterpillar commonly fasts a whole day each time after repeating this operation: some Caterpillars in changing their skins, from smooth, become covered with hair; while others, that were covered with hair, have their last skins smooth.

The food of Caterpillars is chiefly or entirely of the vegetable kind. The larvæ * of Beetles live under the surface of the earth, and prey upon smaller Insects, on the roots and tender fibrils of plants, or on filthy matter in general; indeed in the last state beetles are most commonly found in putrid flesh, or in the excrements of animals.

When the Caterpillar has attained its full size, and all the parts of the future Moth, or Butterfly, are sufficiently formed beneath the skin, it prepares to change into the chrysalis or pupa state; some spin webs, or cones, in which they enclose themselves; others descend into the earth and conceal themselves in little cells which they form in the light loose mould; some are suspended by a girdle which

* *Larva* is a term usually applied to the second state of all Insects, except those of Moths and Butterflies, which are called Caterpillars.

passes round the body, and is fastened to the small twigs of trees; and Caterpillars of Butterflies connect themselves by their posterior extremity to the stalks or leaves of plants with their head downwards.

The length of time Insects live in the state of Caterpillars is always the same in each individual species, yet very few species precisely agree to the same period for their changes; some live two or three years, others only a few months, or even weeks, before they pass to the pupa or chrysalis state.

Preparatory to the change, the Caterpillar ceases to take any of its food, empties itself of all the excrementitious matter that is contained in the intestines, voiding at the same time the membrane which served as a lining to these, and the stomach; and perseveres in a state of inactivity for several days. At length, by a process similar to its former moulting, the outer skin, or slough, is cast off, and the creature thus divested of its last skin is what we call the Chrysalis,

PUPA, CHRYSALIS, OR AURELIA.

THE words Aurelia or Chrysalis are equally used to express that inactive state which ensues after the Caterpillar has changed, for the great purpose of preparing for the *Imago*, or transformation to the Fly. Aurelia, is derived from the Latin *aurum*, and Chrysalis from the Greek, and are both intended to signify a creature formed of gold; this however is giving a general title, from a very partial circumstance, as the colour of a considerable number are black, or dark brown, while the splendence of gold is only seen on the Chrysalides of a few species of the Papilio, or Butterfly. The term Chrysalis should therefore be used to signify only those of the Butterfly kind, and Pupa for the Phalænæ, or Moths, as well as those of Sphinxes, or Hawk Moths.

That very intelligent naturalist M. de *Reaumur* explains the cause of this brilliant appearance; it proceeds from two skins, the upper one a beautiful brown, which covers a highly-polished smooth white skin: the light reflected from the last, in passing through the uppermost, communicates this bright golden yellow, in the same manner as this colour is often given to leather, so that the whole appears gilded, although no gold enters into that tincture.

The exterior part of the Pupa is at first exceedingly tender, soft, and partly transparent, being covered with a thick viscous fluid, but which drying forms a new covering for the animal.

The time each Insect remains in this state is very easily ascertained by those who once breed them, as they always remain the same space

of time, unless forwarded or retarded by heat or cold, but in different species they vary considerably ; for example, the *Papilio Atalanta* (*Red Admirable*) remained only twenty-one days in Chrysalis, from the 12th of July to the 3d of August, but the *Phalena Os.* (*Heart Moth*) remained from the beginning of October till May following ; and many species remain a very considerable time longer than this.

When the Insect has acquired a suitable degree of solidity and strength, it endeavours to free itself from the case in which it is confined ; and as it adheres to a very few parts of the body it does not require any great exertion to split the membrane which covers it ; a small degree of motion, or a little inflation of the body is sufficient for the purpose ; these motions reiterated a few times, enlarge the opening and afford more convenience for the Insect's escape ; this opening is always formed a little above the trunk between the wings, and a small piece which covers the head. Those species which spin a cone, gnaw or pierce an aperture large enough for their emancipation.

The Moth immediately after emerging from its case is moist, with the wings very small, thick, and crumpled ; but they rapidly expand under the eye of the observer, and in a few minutes have attained their full size ; the moisture evaporates, the spots on the wings, which at first appeared confused, become distinct, and the fibres, which were before flexible, become stiff and hard as bones.

When the wings are unfolded, the antennæ in motion, the tongue coiled up, the Moth sufficiently dried, and its different members strengthened, it is prepared for flight. The excrementitious discharge which is voided by most Insects at this time M. de Reaumur thinks is the last they eject during their lives.

INSTRUCTIONS

FOR

COLLECTING INSECTS.

INSECTS are collected in every state, though in the Caterpillar, or Chrysalis, they are preferred, not only as the time of their appearance in the winged state may be then carefully attended to, but they will not be so liable to disfigure and damage their tender markings, as those which have been in the wind or rain; and if they are taken with care from the breeding-cage immediately after their wings have attained a proper size, they may be preserved free from any injury to those beautiful feathers, which are generally much discomposed in such Insects as are taken in flight.

There are some which cannot be found in the Caterpillar state; or if found, cannot be provided with food; those are generally of that kind which collectors term internal, or underground feeders, and either subsist on some substance unknown to us, or which we cannot readily supply. The larvæ of Beetles and many other kinds of Insects, are of this description: numbers of the Moth tribe have hitherto only been taken in the Fly state, and are supposed to feed

in

in the night ; they live in cells which they form in the earth, and come up in the evening to feed, but descend again into their cells before day-break ; it is therefore that some Aurelians have sought for Caterpillars by the light of a candle or lanthorn, and have been very successful : the most valuable insects have been discovered by this means.

Insects are found in almost every situation, the summits of the loftiest trees, and the lowest herbage equally abound, and the gradations between swarm with an infinity of species : the collector must be therefore supplied with a different apparatus, according to the state in which the Insects may be found ; those in present use, though few and simple, require very little improvement, as they answer every necessary purpose. We shall enumerate the following articles, which are indispensibly useful to the collector,

- A large Bat-fowling-net,
- A pair of forceps,
- A number of corked boxes of various sizes,
- Ditto small pill boxes,
- A spare box with cramps, and
- A pincushion well stored with pins of different sizes.

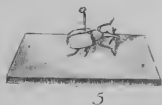
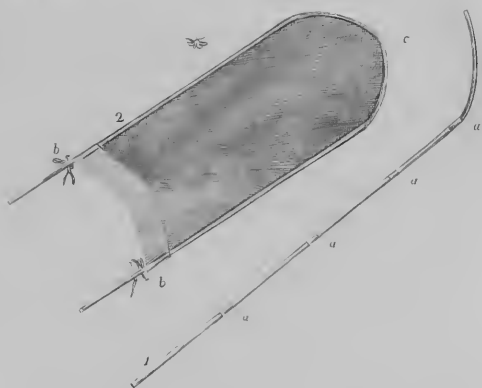
PLATE II. FIG. 1.

represents the Bat-fowling-net, fitted for use.

FIG. 2.

shews the frame, which is made entirely of cane, or of light wood, with a cane bow at the top ; it should unskrew, or disjoint at a, a, a, for the convenience of being conveyed in the pocket.

Note, This frame should not be less than four or five feet in length, when fitted together.



The net is to be made of Scotch gauze, not very fine, and bound entirely round with a broad welt, doubled to form a groove into which the sticks are to slip :—this bordering may be excepted at d d, but the gauze at bottom must be turned up about six inches and form a bag ; each stick or frame when the pieces are fitted together, is to pass into the groove at b b, slip up to c, and be there fastened by a piece of tape through a loop or hole ; let the whole be drawn tight and each side at b b be tied to the nails ; the handles are to be held one in each hand, when the net is used.

With this net it is intended to catch Moths on the wing, and that purpose it answers very effectually, as it may be instantly opened or folded together, and secure the Insect between ; even Insects of the smallest kinds cannot escape, if the net is not damaged and the gauze fine.

It also answers well for collecting Caterpillars.—Expand the net immediately under the bush, or branch you mean to examine, another person may beat or shake the bush with a stout stick, and not only a number of Caterpillars will fall down, but many of the minuter kinds of coleopterous, and other Insects also ; Moths remain torpid and shelter in the bushes in the day time, and by beating are very often taken, as they cannot readily fly away when they fall into the net.

PLATE I. FIG. 3 and FIG. 4.

The forceps are about ten or twelve inches in length, are made of steel, and may be purchased at the hardware shops ; their fans are made either of a triangular or hexangular form, and are covered with fine gauze ; they are held and moved as a pair of scissors, and where they can be conveniently used are to be preferred, as the
Insect

Insect is more confined, and not so liable to rub off its down as when taken in a larger net. If an Insect is on a leaf, both leaf and Insect may be enclosed in the forceps ; or if it be lodged against the trunk of a tree, paling, or any flat surface, you may very conveniently entrap it ; when you have it between the gause, press with your thumb, (or thumb nail if the creature be small) on the thorax, rather smartly, but not so as to crush it ; you may then shake it into your hand to set it, without any apprehension of its flying away : or you may put the pin through the thorax while the Insect is confined between the gause, open the forceps and take it carefully out by the pin.

CATERPILLARS.

MOST Caterpillars lurk among the lowest herbage in the night time, begin to ascend early in the morning, and about noon are found feeding on the tops of their respective plants ; they descend gradually as the sun declines, and at the close of the evening are again concealed in the low herbage : night feeders ascend in the evening, and descend as morning approaches.

To collect Caterpillars it is only necessary to expand the fowling-net, or a large sheet, under the branches, then beat them with a stick or pole, and the Caterpillars will be shook down with the fragments of the foliage and broken twigs.

When you have procured the Caterpillars, be particularly attentive to note the plant on which you found each species, and supply them plentifully with fresh food every day of that kind ; only observe if they are moulting they must not be disturbed, or the stale food be removed, but give a fresh supply when the creature has recovered its strength.

Insects in this state are rarely found on plants which do not afford nourishment to their species, but it sometimes unfortunately happens that stragglers are taken on some particular herbage, altogether of a different nature to its proper food ; and indeed in some cases the most skilful practical entymologists are deceived, the Caterpillar refuses to eat of the proffered plant, and dies. Some * will devour

* As the *PHALÆNA Antiqua*, Vapour Moth ; and all the Tygers.

indiscriminately the leaves of almost every species of plants, and are therefore called general feeders; some * are more limited in this particular, but feed on several kinds; others * are designed to eat the leaves of two or more plants, and a few subsist on one species only †.

Neither can any certain criterion be formed as to the part of the plant, for though most Caterpillars devour the leaf, some subsist on the roots ‡; others on the buds §, flowers, fruit ||, and indeed on every other part ** of the plant, shrub or tree.

It is not always possible if one kind of food cannot be procured with convenience, to determine from the quality of that food, what other kind will best suit the creature; sometimes plants of the most opposite nature have nourished the same Caterpillar. The *PHALÆNA Antiqua* has devoured leaves of the thorn, and of the rose; and has thrived well when fed on the poisonous laurel, and the deadly nightshade.

They should always have an abundance of food, for some kinds devour a very considerable quantity in a few days: the *PAPILIO Brassicæ*, Cabbage Butterfly, eat in one day twice its own weight of food.

† *PHALÆNA Pavonia*, Emperor Moth; on the rose, bramble, fruit trees, &c.

* *PHALÆNA Verbasci*, Water Betony Moth, on the mullein and water betony.

† *PAPILIO Vorticæ*, Tortoise-shell Butterfly, on the nettle.

‡ *PHALÆNA Pronuba*, Large Yellow Underwing, on the roots of grass.

PHALÆNA Humuli, Ghast, on the roots of burdock.

§ *PHALÆNA Salicella*, Rose Moth, on the rose buds.

|| *PHALÆNA Pomonella*, Codling Moth, in the Apple.

** *PHALÆNA Pfi*, Grey Digger, bark of fruit and willow-trees.

SPHINX Apiformis, on the internal part of the wood poplar.

PHALÆNA Cossus, Goat, on the internal part of the wood of most trees.

Doctor Lodovico Bellardi, a learned and ingenious Botanist of Turin, discovered, about six years ago, after a number of experiments, a new method of feeding Silk-worms, when they are hatched before the mulberry-trees have produced leaves, or when it happens that the frost destroys the tender branches. Whether this discovery may be applied with equal propriety in other instances seems at present undetermined, though from some recent experiments we are inclined to believe the possibility of feeding Caterpillars in backward seasons in this manner; we have tried several Caterpillars which were nearly full fed on the leaves of thorns and oak so prepared, and have observed them to eat it when no other food was given, but cannot say how they may thrive if fed on that aliment alone. This new method consists in giving the Caterpillars the dried leaves of their usual food, powdered and moistened; and repeated experiments, says our author, prove that they (the Caterpillars of Silk-worms) prefer it to any other, and eat it with the greatest avidity. The leaves must be gathered about the end of autumn, before the frost commences, in dry weather, and at times when the heat is greatest. They must be dried afterwards in the sun, by spreading them upon large cloths, and laid up in a dry place after they have been reduced to powder. When it is necessary to give this powder to the Caterpillars it should be gently moistened with a little water, and a thin coat must be placed round the young worms, which will immediately begin too feed upon it.

THE BREEDING CAGES

May be made of deal, in the form represented at FIG. 2, PLATE I. with a frame door covered with gauze, or crape, to admit fresh air; and a hole in the bottom through which the

stalks of the plants may be put into a phial of water to preserve them fresh.

Those cages should never contain more than one kind of Caterpillar, as some species devour others; and indeed, if left without food, will devour those of their own kind also.

“ Let not the boxes which are taken in the pocket for Caterpillars, nor the cages made for breeding Insects be made of deal or fir, except they be well lined with paper; for the effluvia of the turpentine, raised by the heat of the pocket, or that of the sun, is extremely prejudicial to them, and seldom fails to destroy the greatest part of the Caterpillars contained therein for any length of time. The cause of the deaths of the Caterpillars, found at the bottoms of cages or pocket boxes, is generally attributed to bruises got in beating the trees for them at the time of collecting them, which is a great mistake, as those which happen to be injured in beating, seldom die till the time of changing their skins, or of their transformations, and will nevertheless eat heartily till either of these times approach. If the inside of the cages or boxes be well lined with paper, as aforesaid, and air-holes made in the sides and tops, covered with crape, canvas, &c. to admit air, it will in a very great measure prevent the above ill effects.” — *Harris*.

Put a small quantity of moist earth, about an inch deep, at the bottom of every cage, but if the Caterpillars are large, more in proportion; always allowing a sufficient quantity for them to bury in.

The cages must never be exposed to the scorching rays of the sun; on the contrary, place them in some cool shady situation.

And the Chryfalides should be preserved in some cold, or moist place, in the winter ; for by being kept too dry the earth about them will absorb the nutritive moisture from the Animal, thereby not only weakening it, but hardening the shell, so that its strength will be insufficient to burst open the case when it should come forth ; and thus enclosed it must perish miserably.

The larvæ of many Insects that feed beneath the surface of the earth may be bred by the Aurelian in the following manner : let any box that is about three or four feet square, and two or three feet deep, be lined or covered externally with tin, and bore through the sides and bottom a number of very minute holes : put into this box a quantity of earth that is replete with such vegetables as you are certain the Caterpillars subsist on, and sink it into a bed of earth, so that the surface may be exposed to the different changes of the weather, unless the sun is very hot, or the rain heavy ; you may then put the Caterpillars into the box, and to prevent their escape, cover the opening with brass or iron net-work.

PUPA.

WE have before observed, that Insects taken in this state are most likely to be perfect and vigorous, and are therefore more generally sought for by Aurelians than even when in the Caterpillar state. Some Chrysalides are buried in the earth; some penetrate into rotten wood; and some lie concealed underneath the bark of trees.

An instrument after the form of a hoe or trowel is used when you search for those of the first kind; and the only places worthy attention are at the roots of trees, as oaks, elms, &c. or beneath the underwood: open the earth close to the tree and search to the depth of several inches.

Such as penetrate into wood, require more care lest they be destroyed when the attempt is made to extricate them; found on the bark with a stick and you will discover hollows where no external signs are visible; tear off the bark, and with a knife cut away the wood that surrounds the orifice of the cavity to enlarge it, and take out the Chrysalis as carefully as possible.

Whether found in the wood, or adhering to the inside of the bark, it should be preserved with the same substance in the breeding boxes; and if found spun up on the branches of trees, or in the mould, manage to adjust them in a similar manner in the boxes.—They must be handled as little as possible, and be very careful

not to press on any part ; as the least rough treatment will either kill or cripple the Insect within.

Swammerdam used to hatch the eggs, feed the larvæ, and preserve the pupa of aquatic Insects, in a shallow dish, which he covered with white paper, occasionally moistened, and pierced in several parts for the admission of air.

PERFECT STATE.

It is in this state we find an immense quantity of Insects, of whose Larvæ or Caterpillars we are altogether ignorant ; and indeed such are the dispensations of Providence to this inferior rank in the scale of animated nature, that many are provided with the means of subsistence, in the most secret situations ; they are hatched in the midst of plenty, and instinct prompts them not to remove from it ; but when they are matured that same instinct bids them burst the shackles of their bondage.

Such as wish to collect, should pay a proper attention to the state of the weather ; if it proves fine, and the sun emits much warmth, Insects are very brisk ; but if a cold or windy day it will be only a fruitless toil to attempt collecting, as all Insects at such times shelter within the herbage, and instead of flying upward, as usual when disturbed, they dart into the thickest of the underwood ; or if once they rise above the bushes, they are impetuously hurled by the current of the wind, far beyond the reach of the fowling-net.

“ The *Garden White* is as good a token for fine weather as may be ; when these flies are out in a morning, it seldom or ever happens but a fine day ensues. This fly is also called a *Tally* for the *Swallowtail*, which appears from the *Chrysalis* at the same time of the year.” — *Harris*.

For the smaller kinds of lepidopterous Insects, before sun-rise or after sun-set ; though many may be taken by beating the bushes in the day time.

Butterflies are abroad in the day time only ; and the best time to collect Moths on the wing, is during the night, especially an hour or two after sun-set.

At day-break many Insects are on the wing ; and most kinds are observed in hot weather to come forth after rain, to enjoy the humidity of the air, which is then damp but warm. This is the best time for collecting, as their wings are less liable to stiffen before they can be set.

The males of some, if not of every species of the Moth tribe, and perhaps of other Insects also, by a very astonishing faculty, are able to discover the females at a great distance, and in the most secret situations ; this has been before noticed by *Barbut*, *Harris*, and others ; and some collectors have endeavoured to find the male Insects by this means ; they enclose the living female in a breeding-box, and place it as near the usual haunts of the species as convenient, the males will generally be observed soon after, fluttering on the box, and endeavouring to gain admission to the female. This experiment is generally practised with success on the *Pex*, and *Egger*, Moths.

Every species has a distinct time for its appearance, and this punctuality is scarcely forwarded or retarded a few days, except by the unusual mildness or inclemency of the season : if you discover a brood of Insects at a certain time of the year, precisely or nearly at the same period of the year following, you will find a brood of the same species ; unless by accident they have been destroyed. It

s true that some Insects are very variable in this particular*, and appear in one season but disappear the next ; which however will not be observed with most kinds.

It is also to be remembered that certain spots of ground, or particular situations, should always be noticed ; those are termed by collectors the haunts of Insects, and however unnecessary this may appear, experience will ensure, that some kinds are confined to one certain spot, and are not to be found in any other part of the same wood ; so that having once discovered the haunt of an Insect, you may be able every season to take some of that species ; or perhaps oftener, as some kinds have two or more broods every summer.

The sequestered vale, the hill, meadow, garden, and even dungh-heap, are the usual haunts of certain species ; the PH. HUMULI has been called the Ghost, not only from its white colour, but as being generally found in church-yards, where an abundance of burdock is permitted to grow ; the PH. GROSSULARIATA, Large Magpie or Currant Moth, is mostly found in gardens ; the PH. FESTUCÆ invariably near marshes ; the Heath Moth receives its English name from the situations it is always discovered in ; and the species of Butterfly known to collectors by the name Chalk-Hill Blue, is taken on the chalky hills and pits leading to *Darent Wood*,

* The SPHINX *Convolvuli*, *Convolvulus* Hawk Moth ; and the PAPILIO *Hyale*, Clouded Yellow Butterfly, were common about London in the year 1781, but have been very scarce ever since, especially the former : and the PAPILIO *Cardui*, Painted Lady, sometimes disappears for several years ; the year before last they were taken even flying in the streets, but last season few, if any, were seen : and the PAPILIO *Antiopa*, Grand Surprise Butterfly, or Camberwell Beauty, was discovered several years since in the vicinity of Camberwell ; it again disappeared for some years ; two seasons since several specimens were taken in different parts of the kingdom, but last summer we cannot learn that even a single specimen was seen.

a little distance beyond *Dartford, Kent* ; the usual haunts of the Red Arches Moth, is among the oaks, &c. within the intricacies of the wood ; but of the Scallop-Shell Moth, the skirts or lanes near ; the Meadow Brown Butterfly, in meadows ; the Gothic Moth, against banks ; and most coleopterous Insects, or Beetles, in dung, &c.

Having now given an outline of all the rules which appear necessary for the purpose of collecting Insects, we shall proceed to their preservation, which above all will act as a particular incitement to the early collector, who it is supposed would feel very little pleasure at the recollection that all the fruits of his toil in one season would be destroyed in the next ; or at best that his specimens would only retain a wretched vestige of their original perfection.

SETTING AND PRESERVING

OF

INSECTS.

COLLECTORS are generally satisfied, if they can obtain the Insect in its last, or fly state, but as a few instructions for the preservation of the Egg, Caterpillar, and Chrysalis, may induce some future Naturalists to enrich their cabinets with such specimens, in addition to the Insect itself, we have selected a few particulars for their purpose.

THE EGG.

The eggs of most Insects retain their form and colour well, if preserved in the cabinet, but those which do not promise fairly, may be prepared after the method practised by *Swammerdam*; he used to pierce the eggs with a very fine needle, and press all the contained juices through the aperture; then inflated them until they regained their proper form by means of a small glass tube, and lastly filled them with oil of spike, in which some resin had been dissolved.

THE

THE CATERPILLAR.

The preservation of Insects in this state, is not only one of the most curious, but useful discoveries that have been made in this department of science. They may be preserved by being plunged into phials filled with well rectified spirits of wine : this method should ever be preferred by those who collect in a distant country, if their subjects are not likely to be injured by such a process, the most delicate Caterpillars will retain their exact size, but the spirits will generally extract the colour, and from those especially which have very tender skins.

But the manner in which *Swammerdam* preserved his Caterpillars, completely obviates this defect, and if carefully managed, it not only preserves the exact size, but generally retains the colours as perfectly as in the living creature.

He used to make a small incision or puncture in the tail, and having very gently and with much patience pressed out all the contained humours, injected wax into them, so as to give them all the appearance of healthy living Insects. In this manner he has preserved many very small specimens.

There is another method which is more generally known to collectors ; it consists in taking out all the inside of the Caterpillar, and inflating the skin by means of a glass tube.

The entrails, with whatever of the fleshy substance can conveniently, is drawn through the anus by means of fine wire curved at the end ; when the inside is emptied, the glass tube is inserted

into the opening, through which the operator continues to blow while he turns the skin at the end slowly round over a charcoal fire ; this hardens the skin equally, and dries up all the moisture within ; a pin is then put through it to fix it in a standing position : if the skin is tender it may be filled with white paper or cotton.

But this is a most cruel operation on the little victim, and such as must shock the feelings of the human soul ; if therefore any other method can be introduced which will effect the purpose in a short time, the practice should be exploded as wanton barbarity.

Various attempts have been made, and among these some have tried to drown the Caterpillar, but you will never be able to accomplish its death in this manner, unless it remains for a considerable time under water, and though it may appear dead, the principle of life will not be destroyed. Mr. *Bonnet*, making experiments on the respiration of Insects, had one Caterpillar which lived eight days with only two of its anterior spiracula in the air.

The method we wish to recommend is to observe when the Caterpillar is on the point of casting its last skin ; drop it by the threads into scalding water, and quickly withdraw it ; the creature will be killed instantly ; then put it into some distilled vinegar mixed with spirit of wine, which will give a proper firmness to all the parts and accelerate the separation of the skin from the body ; the flesh may be carefully extracted, and the exuvia or skin be blown up by means of a glass tube while suspended over a charcoal fire, as before described.

Anoint it with oil of spike in which some resin has been dissolved, unless it is a hairy Caterpillar.

THE PUPA OR CHRYSALIS.

When Insects have quitted the pupa state, the case will require only to be put into the drawers or boxes with some camphire, but those which have the Insects within, must be either dropped into scalding water, or inclosed in a small chip box, and exposed to the heat of a fire, which will shortly kill the Insect within.

I have found that if those chrysalides which have the appearance of gold, are put into spirit of wine they will always retain that colour, but if the Insect within is killed first, or if the fly has quitted it, such appearance is entirely lost.

THE LAST,
OR
PERFECT STATE.

COLEOPTEROUS INSECTS,
OR
BEETLES.

THE preservation of this order of Insects, is attended with very little difficulty.

If you drop them into scalding water they die in an instant, but the moisture they imbibe can never be sufficiently exhaled to prevent mouldiness, after they have been a short time in the cabinet.

The best method is to enclose them in a small chip box, and kill them by exposing the box to the heat of a fire ; this treatment will rather absorb, than add to the superfluous juices of the Insect, and greatly contribute to its preservation.

Those of the *Meloe* genus have soft tender bodies which shrivel after death ; to preserve those, make an incision at the extremity of the abdomen, probe out the entrails and fill the cavity with fine tow.

Several

Several foreign species of *Cassida*, and many other coleopterous Insects, are beautifully variegated with a golden colour that dies with the creature ; if you plunge them into well rectified spirit of wine, when alive, they soon expire and retain their golden appearance ; but if taken out and dried, that brilliance will be irretrievably lost.

The Chinese seldom take care to display the parts of their Insects after the European manner ; those we receive from China are stuck on long needles ; if Beetles often through one elytra, so that the membranaceous wings are entirely concealed.

If the Insects require only a little relaxation to extend the parts, use a camel's hair pencil moistened with spirit of wine ; but if this should prove insufficient, fix them on a piece of cork and float them in an earthen pan half filled with water ; it is better to cover the pan with a damp cloth, and the Insects will be so limber, after a few hours, that they may be reset in any position.

Large Beetles are usually stuck through one of the shells, as at **FIG. 5, PLATE II** ; but smaller Insects are better if displayed on a small piece of card, as at **FIG. 6, PLATE II**. (they must be fixed to the card with strong gum) ; or they may be pierced through the head as at **FIG. 7, PLATE II**.

Insects of the hemiptera order, as *Cimices*, &c. may be treated in the same manner.

LEPIDOPTEROUS INSECTS,

AS

BUTTERFLIES, HAWK-MOTHS,
AND MOTHS.

It is usual to put two specimens of each species of the Butterfly kind into the cabinet, one to display the upper, and the other the under side; for the under side is much more beautiful in most species, and differs entirely in appearance from the upper side.

Sphinxes and Moths are generally disposed in pairs to shew the male and female, and as their under sides are seldom very beautiful, only their upper sides are shewn.

Except a few species, Moths constantly conceal their under wings when at rest; but collectors sacrifice the propriety of their remaining in a natural position, in order to display the under wings.—It is advisable to have one of every kind in a natural posture, as that will often essentially assist to determine the family of the Insect.

Provide a quantity of card braces, made in the same form as that represented at FIG. 8, PLATE II; and a board of a convenient size,

size, covered with soft cork ; it must be perfectly even on the surface, and papered ; this is termed the setting board.

For small Moths it is only necessary to put the pin through the thorax and they die in a very short time ; but for larger kinds, the pin should be dipped in strong aqua fortis before it is put through the Insect.

It is very difficult to kill the largest kinds of Moths and Sphinxes :—select a large pin (comparatively for the size of the Insect) and dip it into aqua-fortis as before, but immediately that the pin is forced through the thorax withdraw it, and put a drop of aqua fortis into the wound ; should this prove insufficient to kill it, put the point of the pin through a card, and hold it in the flame of a candle until it becomes red hot ; this will kill the Insect immediately, and the card will protect it from being injured by the flame.

The Moth is then to be fixed on the setting board, and the braces are to be applied in the manner shewn at FIG. 9, PLATE II. The wings are to be carefully displayed by means of a large pin, and the braces put close down to prevent their return to the natural position.—*Note*, All Insects must be set while they remain limber, for if the parts stiffen they are apt to snap ; they may be relaxed by floating them in a pan of water.

Insects should remain beneath the braces on the setting board until all the aqueous moisture be evaporated, or the wings will start from their position, and the bodies turn black, or mouldy ; they should be placed in a dry situation, and be covered with gauze for

the admission of air for the space of a month at least, before they are put into the cabinet.

It is proper in this place to caution the young beginner not to attempt to kill the Insects by fumigations of sulphur, &c. a practice too frequent with persons of this description, for should he by this means deprive the creature of its life, he will also deprive it of its beauty : It is even doubtful whether many may not survive the operation.

M. Lyonet placed several of the large Musk Beetles, probably the *Cerambyx Moschatus*, under a glass where he had been burning sulphur, and which he kept burning while they were there ; and though the vapour was so thick that he could not discern them, and that he kept them therein more than half an hour, they did not seem in the least incommoded*.

Some Moths are very liable to change colour when placed in the cabinet, and particularly those which collectors term *full-bodied* ; an oily matter is common to all Insects, but those are charged with a superabundance. It appears at first in spots on the body, but gradually pervades every part ; in some it will even descend into the wings, and then an obliteration of all the tender marks and beautiful specklings is the least that may be expected, if a total change of its colours, to an uniform dirty brown, does not ensue. Hence it is that many of the Linnæan descriptions of Insects appear defective to such as breed them ; we not unfrequently read, *body black*, though we know that part of the Insect is

* *Leſſer Theologie Des Inſectes. Tom. I. p. 124. Ibid p. 126.*

white in every specimen that is not greasy; the body of the Satin Moth * is perfectly white when fine, but after it has been killed some time, it becomes black in parts; the body of the Burnet Sphinx † is of a very brilliant blue colour, with yellow bands on every annulation, when alive, but changes to a velvety black soon after the Insect dies; the same is observed on the body of the Currant Sphinx ‡; and every part of the body of the Hornet Sphinx § changes to a jet black, after being some time in the cabinet; although when alive it is a very bright yellow, with a band of purple. Hence also it is that some specimens of very common Insects are valuable, by having preserved their proper colours uninjured.

Various methods have been tried to extract the grease from the Moths, but a preventative should always be preferred.

If the grease has not spread into the wings, the Insect may sometimes be cured, but it will be very difficult, if not impossible, to eradicate the grease which has settled in patches on the wings.

Large Moths are to be opened in a straight line along the under side of the body, the entrails, &c. taken out, and the cavity filled with fine tow or cotton.—*Note*, This should be performed soon after the Insect is dead. The most delicate specimens may be preserved entire by this means; we have some very valuable Sphinges, Moths, &c. which were collected by an intelligent person in *North America*; they retain their colours to the utmost degree of perfection, and have only been prevented from changing black by this simple preparation.

* *Pha. Salicis*. † *Sp. Filipendulæ*. ‡ *Sp. Tipuliformis*. § *Sp. Apiformis*.

Sometimes it will be proper to break off the body close at the thorax, and substitute the body of another Insect which nearly resembles it, and which is not so liable to change.

The method which is most successful for recovering the original appearance after the Insect has become greasy, is to powder some fine dry chalk, on a piece of heated iron ; cover the chalk with a very fine linen cloth, and thereto apply the under part of the body of the Insect : the heat of the iron dissolves the grease, while the chalk absorbs it, and the linen cloth prevents the chalk from clotting to the Insect. This process may be repeated several times if the grease is not entirely eradicated by the first attempt. Always observe to exactly temperate the heat of the iron.

They may be baked in a slack oven, with the chalk placed to absorb the grease, without any considerable injury to the colours.

Some collectors open the bodies of large Moths, take out the entrails, and fill the cavity with fine dry powdered chalk.

MINUTE MOTHS.

TINEA, TORTRIX, ALUCITA, &c.

Much experience, and considerable care, with a light, but steady hand, are necessary for the management of minute Moths on the setting board ; it will be equally useless and impossible, to enter into a minute detail of every trivial circumstance that must be attended to, we shall therefore give a general sketch, and leave the rest to the ingenuity of the operator.

First, the fans of the clappers, or forceps, or the fowling-net if you prefer it, must be covered with silk gauze, of a very soft and delicate

delicate texture, and as the slightest friction will obliterate the beautiful specklings, or raised tufts that are so profusely bestowed by the hand of nature on this most elegant tribe of Insects, you must be extremely careful when you press on the thorax not to crush it more than you can possibly avoid ; or if you have it between the fans of the forceps, put the pin through the thorax while the creature is confined in that situation.

The next care will be to procure pins of such a degree of fineness, as not to injure or distort the wings of the Insect ; the smallest sort of lace pins will do very well for most kinds, but there are some so extremely minute that even those would be too coarse. If you have pins made purposely for Insects of this kind, let them be about an inch in length, and have them drawn as fine as possible.

When the pin is put through the thorax it must be managed with the greatest dexterity, and be exactly in the center, as the least variation to either side will break the nerves of the anterior margin of the upper wings, which will immediately start, and can never be replaced in a proper position ; if the pin is placed too high, it will sever the head from the shoulders, and by being too low, the under wings also will break off or start from their true position ; it may be managed better with the assistance of a magnifying eye glass.

The braces are to be made of the same form as those which are used for larger Insects, only smaller in proportion ; and instead of making them of stiff card, or pasteboard, they may be small slips of vellum, or stout paper that has been hot-pressed. You must brace them immediately after you have put the pin through the thorax, for if they are permitted to stiffen, they cannot be relaxed so well as larger Insects.

Minute Moths are to be found in winter as well as summer ; it would be scarcely imagined, nay reason would deny, did not experience prove, that when the frost is so severe as to entirely subvert the appearance, and almost annihilate the existence of all the vegetable productions, within the verge of its influence, myriads of those delicately formed creatures brave the inclement season, and exist securely within those habitations they have the address to construct.

A very skilful Entomologist informs us that having occasion to go into the country when the cold was intensely severe and the snow deep, he collected in a few hours a vast number of minute Insects of the *Coleoptera*, *Hemiptera*, and *Lepidoptera* orders ; and though his collection was then very considerable he selected thirteen new species, and among them several which he has never found, but when the weather has been very cold as at that time.

It is proper to observe, that those Insects usually shelter among the moss, and other extraneous matter that grow on the trunks or branches of trees, or beneath the rotten bark. Gather the moss, &c. into a box, or tin cannister, and shut it close to prevent the escape of those Insects, that may revive by the warmth ; when you have an opportunity to examine them, spread a sheet of writing paper on the table, and place a lamp, or candle, with a shade of transparent, or oiled paper before you, so as to weaken the glare ; then separate the moss, and shake it loosely in your hand, and you will perceive many Insects fall down on the paper ; if they are so minute that by thrusting the pin through the thorax they would be damaged, fasten them with gum water, or some glutinous varnish, to small slips or pieces of paper.

NEUROPTEROUS, HYMENOPTEROUS,

AND

DIPTEROUS INSECTS.

AMONG those of the neuropterous order are included the Libellulæ, a most elegant tribe of Insects, but very difficult to preserve. The colours on the body are exceedingly brilliant in some species, but inevitably change black within a few days after death, unless the collector is particularly attentive to their preparation.

They are extremely tenacious of life ; we have seen one of the larger kinds live two days on the pin, and even shew symptoms of life twenty-four hours after being deprived of its head.

The most expeditious method of killing those creatures, is to run a red hot wire up the body and thorax, for they will live a considerable time in agony if you attempt to kill them with aqua-fortis as before directed for the Moth tribe.

After they are dead, clean their bodies on the inside with a little cotton twisted to the end of a wire, and put a roll of white paper into the cavity, or fill it with cotton ; in most species this will not only admirably relieve the colours, but preserve them from changing black.

Note, Those kinds only with transparent skins will require this preparation, as the *L. 4. maculata*, &c.

Some of the foreign Insects of those orders appear to the greatest advantage in spirit of wine, but whenever the usual method will suffice, it should be preferred. They are all to be stuck through the thorax, and observe always to put the pin so far through, that when it is stuck near a quarter of an inch into the cork the feet of the Insect may only touch the surface.

The wings are to be displayed with cramps as usual.

APTEROUS INSECTS.

MANY kinds may be preserved in spirits, or in the same manner as coleopterous and other Insects ; but among those we can include very few, if any, of that extensive genus ARANEA (Spiders), no method having been hitherto discovered whereby they may be preserved in their natural colours, for however beautiful they may be when alive, their bodies shrivel and their tints become an obscure brown, soon after death ; and as the moisture exhales, the size of the body diminishes, very little more than the skin of it remaining when the creature is sufficiently dry to be placed in the cabinet.

Spiders cast their skins several times in the course of their lives ; the exuviae would be very acceptable to the collector, if they retained any of the beautiful colours of the living Spiders.

To determine whether some species of Spiders could be preserved with their natural colours, I put several into spirit of wine ; those with gibbous bodies soon after discharged a very considerable quantity of viscid matter, and therewith all their most beautiful colours ; the smallest retained their form, and only appeared rather paler in the colours than when they were living.

During the course of last summer, among other Spiders I met with a rare species ; it was of a bright yellow colour, elegantly marked with black, red, green, and purple ; by some accident it was unfortunately crushed to pieces in the chip box wherein it was confined, and was therefore thrown aside as useless ; a month or

more after that time, having occasion to open the box, I observed, that such parts of the skin as had dried against the inside of the box retained the original brightness of colour in a considerable degree ; to further the experiment I made a similar attempt with some caution, on the body of another Spider (*Aranea Diadema*), and though the colours were not perfectly preserved, they appeared distinct.

From other observations I find, that if you kill the Spider, and immediately after extract the entrails, then inflate them by means of a blow-pipe, you may preserve them tolerably well ; you must cleanse them on the inside no more than is sufficient to prevent mouldiness, lest you injure the colours, which certainly in many kinds depend on some substance that lies beneath the skin.

After inflating them, you may either inject them with fine virgin wax, or anoint the skin with oil of spike in which resin has been dissolved, and dry them in some shady place.

Of the largest kinds of foreign Spiders, the bodies are the only parts which are liable to shrivel ; if they were prepared in this manner their proper form would be preserved.

In 1792, Dr. Withering presented a paper to the Linnæan society, in which he relates the particulars of a new method of preserving Fungi, &c. ; as we have given an account of this improvement with the instructions for the preservation of plants, we shall only observe in this place, that the composition which he has applied with so much success as a preservative of the most perishable tribes of vegetables, may hereafter prove also an excellent preservative for Spiders, and other apterous insects.

THE CABINET.

It is immaterial whether the cabinet is made of mahogany or wainscot ; sometimes they are made of cedar wood, but very seldom of deal or any other wood that is soft ; the drawers may be from fifteen to thirty inches in length, the same, or nearly the same in breadth, and about two or three inches in depth ; the cork with which the bottoms are to be lined, must be chosen as free from cracks as possible, it must be glued into the drawers to prevent its warping, and be filed, or cut very level ; the irregularities should be rubbed even with pumice stone, and the whole surface be perfectly smooth, before the paper is pasted over it ; the paper should be of the finest quality, but neither very stout, nor highly sized ; the former being liable to turn the points of the pins, and the latter to injure the insects by not readily absorbing the grease, which may flow from them : the top of every drawer must be glazed to prevent the admission of dust or air ; the glass is usually fitted into a frame of the same size as the drawer, and is made either to slide in a groove, or let in on a rabbet. Some collectors wash the cork several times with spirit of wine and corrosive sublimate, to destroy the mites ; and moisten the paper after it is pasted on the cork with allum-water.

Observe that every crevice in the drawers or boxes must be stopped to prevent the admission of external air, and always appropriate a quantity of camphire for each drawer, or the mites will destroy the Insects.

If your cabinets or boxes stand in a damp situation the Insect will become mouldy on the antennæ, legs, &c. this must be cleaned off with a camel's hair pencil, and the cabinets in future be put into some place where it will be less exposed to damp.

If you perceive notwithstanding the camphire, a dusty appearance on the Insects, add also a quantity of musk, and clean the dust off with a soft pencil; if after this you find more dust, either bake the Insects, or dissolve some corrosive sublimate in spirit of wine, and touch the parts that appear dusty with a fine pencil moistened in the liquor, which will destroy the mites that occasion such appearance.

The method which *Harris* advises promises only to materially injure the Insects, or at least change their colours if brilliant, as I have found by experience.

“ If at any time the Insects in a cabinet or box, where they are placed for preservation, should appear as if growing mouldy, or be infested with small *animalcule*, which is known by a kind of dust seen beneath the abdomen; in this case the smoke of tobacco is the only effectual remedy, which must be blown through the small end of a pipe admitted through a hole made for that purpose in the back part of the drawer or box: this not only corrects the putrid and stagnant air, but destroys those formidable enemies which often destroy whole cabinets of Insects: this will preserve them for twelve months, when it will be necessary to act the same part over again. It may be feared and objected that the smoke may in some measure damage the Insects, but a little experience will plainly evince the contrary.”——*Harris*.

C R A B S, &c.

SUFFOCATE them in spirits, either of wine or turpentine, and dry them in an oven.

Or after they are killed, put them into an Ant's nest; those little animals will devour the flesh in a few hours and leave the shell entire.

Diluted aqua-fortis is used to clear off any impurities that may adhere to the shell.

V E R M E S.

This class comprises a number of very singularly formed creatures; most of which may be preserved in spirit of wine.

The ASTERIAS, or Star Fish, belong to the second order of this class; they are very numerous in some places on our coast, are beautiful when alive, but their colours fade after death. Suffocate them in spirits, after which they may be dried and preserved in boxes with a quantity of musk and camphire.

TESTACEA.

SHELLS.

IN this order are included the whole tribe of shells according to the Linnæan arrangement ; many disputes having arisen respecting the proper method of studying the subject, Linnæus made conchology a branch of zoology, and not of mineralogy, as preceding authors had classed them ; there however yet remain very strong arguments against the method by the animals, although it cannot be denied that the shells are only the coverings or habitations, and should not therefore demand our primary attention, or be considered as any farther useful in establishing the mode of classification, than as subordinate distinctions.

Fabius Columna was astonished that of all the writers on this subject, not one had considered the animals that inhabit the shells, but owns, that many are seldom seen by us, and that to discover the manners of their life is extremely difficult.

Mr. Adanson also, in his Natural History of Senegal, wishes to methodize testaceous animals by the Fish in preference to the shells. He observes, that there is such an infinite variety of the *Libot*, or *Black Limpet*, that it is difficult to meet with two shells alike, and that any person would be led to conclude that they were distinct species, did not the fish or animal prove the contrary by admitting of no such differences. The shells differed in colour and form ; some were white, others grey, ashen, or black ; very flat, or very raised ;

raised ; the number of furrows unequal, from twenty-five to fifty ; sometimes rigid, or set with small prickles ; the jaggings or toothings of the Contour also differed widely, some being small, or merely notches, while others were flasht so deep, that they gave the whole shell the form of a star with five or seven rays.

Da Costa, whose abilities as a conchologist will require no eulogium, has however encountered the objections to class by the shells, and has convicted Adanson of having confounded the *Libot*, or *Black Limpet*, with the *Thorny Limpet*, the *Beauty*, and the *Astrolepas Limpets*, all as one species, though they have not the least resemblance to each other. With respect to the fish, he allows with Adanson, that being the same sort is a presumptive proof of their being individuals of the same species, but cannot agree that it is a positive or decisive one. “ I will allow him,” says *Da Costa*, “ that the whole of the external appearance of the fish, and the particular parts are nearly the same ; yet I think even that is not a positive proof, for I imagine, the very same kind of animal inhabits different covers or shells ; as for example, the Snails may be the same kind of fish, and form the genus, yet vary so much in their habitations or shells, as to form different species of that same genus, from only the differences of the shells or coverings : for the shell or covering may be held for as great a character of the species, as the very fish. Thus the volutes called *Admirals*, *Brocades*, *Purple Tips*, or *Onyxes*, *Tigers*, &c. though such different shells may be inhabited by the same kind of fish, to wit, a *Limax* or *Snail*, and therefore though the *Limax* or *Fish* is of the very same kind, and forms or fixes the genus, yet the shells, always constant, will fix or define the species of that same genus. An analogy to this bears strong through all the animal kingdom ; for species of quadrupeds are distinguished and defined in their genera, from the different colours of their hides ;

birds by their various plumage ; and insects by their different colourings, therefore why should not shells, which wear such strong characters, by the same parity of reason, form species of the same genus ? Or in other words, why should not the same fish, or genus, yield many different species, according to the several characteristical differences of its shells or habitations ?”

This author does not attempt to deny the propriety, but practicability of classing by the animal ; he justly observes, “ The vast number of species hitherto discovered, and the numerous collections made, exhibit only the shells or habitations, the animals themselves being scarcely known or described. Of the shells we daily discover, few are fished up living ; the greater number are found on our shores dead and empty. Accurate descriptions of animals whose parts are not easily seen or obvious, and anatomical researches, are not in the capacity of every one to make ; nor are the particular parts and their respective functions so easily cognizable to any but expert, assiduous, and philosophical enquirers. How is it possible then to arrange a numerous set of animals by characters or parts, we can with difficulty, if ever, get acquainted with, in the far greater number of the species we collect or discover ?”

COLLECTING.

LIKE all other kinds of animals, shell fish have their particular resorts; some inhabit only the deep parts of the sea, some are found in less depths, others in shallows, in bays, and even on the shores; it has been also observed, that many very fine and rare specimens are sometimes found in narrow straits between islands, and in shallows of four or five fathom water.

The best live shells are collected by means of a trawling-net, such as are used by fishermen, if the depths will permit; they are also brought up by the cable in weighing anchor, the log-line in founding, &c.

After a storm good shells may be picked up on the sea beaches, or shores, as the violent agitation of the water in a tempest separates them from their native beds, and often casts them on the shore; but such as have been exposed for some time to the heat of the sun, or beaten by the waves, are of little value, as their colours will be faded, and the shells worn and broken; choose therefore always such shells as lie in the deepest parts of their resorts and under water, whether taken up by the drag-net, from the sides of rocks, or bottoms of ships, &c.

River shells are in general very obscure in appearance, seldom admit of elegant colouring, and are extremely thin and brittle.

But terrestrial or land shells, though few in comparison with marine shells, are no way deficient in beauty, or less esteemed by collectors.

Many shells are so very beautifully polished when they are fished up, that art cannot improve their appearance, such are the Cowries, Tuns, some Buccina, the Volutes, and the Olives.

Da Costa imagines that the fish inhabiting all naturally polished shells whatever are capable of not only adding to the extent and growth of their shells, but can likewise, from time to time, add a fresh polished covering to the whole shell; or at least extend their organs to such a length as to clear away all impurities from their shells, as we seldom find any Cowries with coral or any extraneous bodies adhering to any part of them.

As shells are of a calcareous nature, all acids must be avoided as much as possible; and even when the animals are killed, as much boiling may injure the shells, it will be most advisable to dip them into scalding water, which will kill them, let them remain for two or three minutes to cool, and then put them into cold water, in which they may lie until they are taken out to be cleaned. If the animals die without this precaution the colours will be very dull and obscure, if not entirely changed.—Those are known to collectors by the term *Dead Shells*, and are little valued because the colours are so very much injured.

The fish by being killed in this manner becomes condensed, or somewhat solid, and may be picked out by any sharp instrument.

The epidermis, or periostracum, is common to many shells, and is perhaps a membrane that covers the shells to defend them from exterior accidents, and aid their growth; its structure in different genera varies very much; in some it is laminated, in others fibrous or brush-like, or as velvet; it prevents shell-fish or other marine insects from fixing their habitation on those shells, and protects it from the corroding of the salt water, for all shells that have the epidermis have a scabrous surface.

Tellens, Muscles, Snails, &c. come out of the sea slimy or even encrusted with filth, coralline matter, moss, &c. For these, first steep them in hot water, let them remain therein for twenty-four hours, to soften the filth or crust, then brush them well, with brushes that are not too hard; if that proves insufficient to clean them, rub or brush them again with tripoli or emery, or put them into weak acid, observing to dip them into cold water every minute; strong soap may also be used with a rag of woollen or linen, to rub them, and when cleaned finish them with a soft brush and fine emery.

The scientific collectors should always if possible preserve one of every shell with the epidermis on, to exhibit its natural appearance, together with the uncoated specimen.

The epidermis may sometimes be so thick that it will be proper to take it off, before the shell can be polished, for that purpose pour a proportion (nearly one tenth) of aqua-fortis mixed with common water, into a shallow basin or saucer, and place the shells therein, in such a manner that the corrosive liquor may act only on the coat, without injuring the orifice, which in some cases may be coated with bees-wax; change the situation of the shell every two or three minutes,

minutes, that all the parts may be equally uncoated; wipe off the bubbles as occasion may require with a feather, first dipped in water: when you perceive the enamel of the shell in any part free from the coat, take it out and wash it entirely free from the aqua-fortis: after this process brush them with emery, putty, or tripoli.

If instead of a thick epidermis it is only a pellicle, it is sufficient to steep it in hot water, and then pick it off; or steep the shell in vinegar for some time till it peels off freely, or is corroded away.

The epidermis of some shells is so very coarse and ponderous as to resist the corrosive quality of acids diluted, or even strong aqua-fortis; coarse emery, with strong brushes, are then substituted, and seal-skin or pumice-stone is in several respects useful. If the matter is too obstinate to be cleared off by this means, pour some spirit of nitre into a cup or other vessel, stop up every part of the shell that may be susceptible of injury, with soft wax as carefully as possible, and put it into the liquor in the vessel; remove it every minute into cold water, but observe never to shift it into the same water more than once, and wash it every time before you return it into the corrosive liquor. If the shell is warted, irregular, or armed with points, examine with a common magnifying glass, and if you perceive on the more prominent parts through the coat any appearance of the polished surface, cover them with wax, and let the shell remain a few moments longer in the spirit; take it out and wash it again, after which polish the shell with fine emery, and pass a camel's hair pencil with gum arabic over them to glow the colours; white of egg is sometimes used, but it is very apt to turn yellow in time, though at first it appears glaring; and varnish communicates a disagreeable smell.

Some shells have naturally a slight politure, though dull ; those must be rubbed by the hand with chamois leather, which will give them a bright glossy appearance ; avoid when possible the use of powder of emery, as it is apt to detriment the beautiful workings on the shells ; it cannot however be often left out of use.

It may be necessary as far as can be, to avoid the impositions which are often practised on those who are not well acquainted with shells ; at the same time that the collector may wish to enrich his cabinet with specimens under their several appearances : thus we see that though the outer surface of the common Cowry, or Tide Shell, is of a pale colour with dark spots, when that is taken off, it is of a fine violet colour ; the Sea Ears are clouded with brown, green, and white, but when that coat is rubbed away, it appears a beautiful mother of pearl, and the pearly chambered Nautilus, or Sailor, is of a light ochre colour, variegated with streaks of red, externally, but when that coat is rubbed off, the shell is mother of pearl also ; the same circumstance attends many of the Trochi, Snails, and an infinite variety of other shells of different genera. Among those shells which alter their appearance most, we must not omit the Volute, called by us the *Purple* or *Violet Tip*, and by the French the *Onyx* ; it has a brown epidermis, which being taken off discovers the ground colour to be a dull yellow. When this is worked down to beneath the crust or surface, it is of a pure white, with the tip of a fine violet colour.—To rub them down in this manner use a file, hard brushes of boar's bristles, coarse emery, &c.

The Dutch frequently stain artificial colours on shells, so as to render it extremely difficult to prevent imposition ; sometimes they entirely alter their appearance, by filing the mouths, &c.

To examine the internal structure of shells, they may be ground down on a hone.

Fossil shells should be noticed here if any instructions were required for their preservation, but they, together with minerals, are the most durable part of a collection ; being either chalky, casts of stone, or replacements of sparry matter, with perhaps only some slight fragments of the shells adhering. They are dug out of lime, or stone quarries, coal pits, chalky cliffs, &c.

The remains of foreign animals, shells, and plants which have at different periods been discovered in a fossil state, within the bowels of the earth, in Europe, has been supposed to exceed the variety and number of those in a recent state, or in present existence with us ; and although *Buffon* will not allow such a considerable latitude to this circumstance, he acknowledges that fossils are extremely numerous in Europe as well as in every other part of the universe, and appears satisfied that shells, &c. may be discovered wherever we are disposed to seek for them.

Strata of shells have been found at the greatest depths from the surface of the earth that have ever been examined, and in equal abundance on the summits of the highest mountains, for example, on mount Cenis, in the mountains of Genes, in the Apennines, and in most of the stone and marble quarries in Italy ; in the marbles of the most ancient buildings of the Romans ; in the mountains of Tiröl ; in the center of Italy, on the summit of mount Paterne, near Bologne ; in the hills of Calabria, and in many parts of Germany, Hungary, &c.

In Asia and Africa they have been observed by travellers in many parts ; on the mountains of Castravan above Barut there is a bed of white stone as thin as slate, each leaf of which contains a great number and diversity of fishes ; they lie for the most part very flat, and compressed, as do the fossil of fern-plants, but they are notwithstanding so well preserved that the smallest traces of the fins, scales, and all the parts which distinguish each kind are perfectly visible. Many petrified shells are also found between Suez and Cairo, and on the hills and eminences of Barbary. Also according to *Bourguet* in the long chain of mountains which extends from Portugal to the most eastern parts of China.

“ Opposite the village of Inchene, and on the eastern shore of the Nile, are found petrified plants, which grow naturally in a space about two leagues long, by a very moderate breadth ; this is one of the most singular productions of nature. These plants resemble the white coral found on the Red Sea *.”

“ There are petrifications of divers kinds on mount Libanus, and among others flat stones, where the skeletons of fish are found well preserved and entire ; red chefnuts, and small branches of coral, the same as grow in the Red Sea, are also found on this mountain.”

According to Dr. Woodward, fossil shells are met with from the tops to the bottoms of quarries, pits, and the deepest mines of Hungary ; and Mr. Ray assures us, they are found a thousand feet deep in the rocks which border the Isle of Calda in Pembrokeshire in England.

* Voyage of Paul Lucas, Vol. II. p. 380.

We would willingly pursue our enquiries farther, were they subservient to our general design, but as we only wish to acquaint the early naturalist, in what situations he may expect to meet with fossil shells, or the remains of animals, &c. we shall return to our own country, which abounds in productions of the fossil kind.

The greatest variety of ferns, and other fossil plants, in iron-stone, are found at Coalbrook Dale, Shropshire; ammonites, &c. in Kent, Dorsetshire, Gloucestershire, Cornwall, Bath, &c. and fossil shells in general are abundant in chalky cliffs, and clay soil. To convey some idea of the extensive variety of fossil shells, &c. in this country, it will be only necessary to mention the *Fossilia Hantoniensis*, the figures contained in that work amount to one hundred and twenty-one different kinds, although they were only collected in the county of Hampshire, out of the cliffs by the sea coast, between *Christ Church* and *Lymington*, and about the cliffs by the village of *Hardwell*, which is nearly in the mid way between the two former places; they were found in their natural state, excepting their loss of colour, and exceedingly well preserved, below a stratum of gravel and sand about fourteen or fifteen feet thick, in a bluish kind of clay or marle, quite down to the level of the sea, how much deeper is not known; the heights of these cliffs are, in many places, above one hundred feet.

We cannot better conclude this discourse, than by subjoining the following extract from the preface of that work.

“ This stratum of clay runs a great way into the country in a northerly direction quite across the *New Forest*, as may be perceived when sinkings are made in the earth for buildings, or pits for the digging of marle, where fossil shells, on such occasions, frequently occur,

occur, together with those other bodies here mentioned, by which it appears, that along with the testaceous tribe, fish and quadrupeds became involved in the general confusion; the shores under these cliffs abound with large noddules of iron ore, and pebbles or flints, in many of which when broken are discovered fossil shells, or their impressions, and the escharæ here described.

“ Various are the opinions concerning the time when and how these bodies became deposited; some there are who conceive it might have been effected in an indefinite length of time by a gradual changing of the sea; others again, that this globe may have undergone many, even total revolutions, of which we neither have or can have any idea, but by these traces.

“ The most common cause assigned is that of the deluge, but the notion that an overflowing of the waters, during the time mentioned in scripture, although the universality of it should not be called in question, could have loosened the intire contents of the whole earth, according to Dr. *Woodward*, and have rendered all that was solid, fluid, for the admission of the spoils both of the sea and land, into the centre of the hardest rocks, nay even pebbles and flints, is equally hypothetical with other conjectures; so that upon the whole, I am apt to think this affair will for ever remain a mystery. I shall therefore content myself with making a few general observations on the subject, the better to enable such as are less conversant in these matters to judge for themselves.

“ These phænomena then, upon an inquisitive search over as great a part of the globe as we have any knowledge of, except in a very few instances, are found to be universal; for from the surface of the highest mountains in the most inland parts, down to the great-

est depths in the earth ever penetrated, where openings have been made, are found shells, bones, and vegetables, petrified, or preserved in their natural state, in earth, sand, clay, marble, flint, &c. and in such abundance, that the testaceous tribe especially are equal in variety to those found recent, and in quantity infinitely exceed them. The greater part of these fossil extraneous substances that are known, are found to be inhabitants of southern latitudes, as the skeletons of Elephants, Crocodiles, Sharks, and almost all the vegetables; and of the testaceous tribe are found the Ammonitæ, Belemnitæ, Stellæ Marinæ, Anomixæ, &c. now in general not known in the recent state, inhabitants no doubt of the great deep, or of some unknown seas or shores; all of which are met with in great plenty in this our island *."

M. de Jussieu imagines, that as the bed of the sea is continually rising in consequence of the mud and sand which the rivers incessantly convey there; the sea, at first confined between two narrow dykes, surmounted them and was dispersed over the land, and that the dykes were themselves undermined by the water and overthrown therein; hence he accounts for the impressions of so many exotic vegetables on the stones of St. Chaumont, in France; which are all either natives of the East Indies, or the hot climates of America, and are not to be found in the recent state in any part of France.

* FOSSILIA HANTONIENSIA, Collecta et in Museo Britannico deposita a Gustavo Brander, R. S. and S. A. S. Mus. Brit. Cur.—Lond. 1766.

LITHOPHYTA, ZOOPHYTA, &c.

SEA WEEDS only require to be washed in fresh water, and dried between sheets of paper.

For the preservation of some kinds of Corallines, &c. it will be necessary to wash them first in spirit of wine to kill the insects which are concealed in the hollows or crevices, and then in common water to clear off the extraneous matter, &c.

A receipt for cleansing white corallines, &c. when dirty, or changed black, is very little known; put them into a mixture of soap-suds and a small quantity of pearl-ashes, and rub them therein with a soft brush; however changed, or dirty they may be, their finest degree of whiteness will be regained by this process. Fumigations of sulphur will also whiten coral that has turned black.

In the last order it only remains for us to notice the Polypes, whose very astonishing power of reproducing the parts, which they may be occasionally deprived of, has given birth to so many learned discussions in every part of Europe.

We often observe at the bottoms of shallow pools, or on the plants which grow in, or recline on the surface of stagnant water, a number of small transparent lumps, about the size of a pea, and flattened on one side; these are Polypes in an inactive state: they are generally

generally fixed by one end to some solid substance, at the other end is an opening, which is the mouth of the creature, and the arms shoot forth round it in the form of rays.

They are generally found in waters that move gently; neither rapid streams, nor stagnant waters ever abound with them; they adhere to aquatic plants, to rotten wood, stones, &c. They are seldom met with in winter, but in the month of May they begin to appear, and are to be found in ditches all the summer.

When you search for Polypes it will be best to take up a quantity of the pieces of wood, &c. that are usually found in ditches, and put them into a glass of water, let it stand for a while without moving it, and if there are any Polypes adhering to these substances, you will perceive them stretching out their arms in search for their prey.

Mr. Trembley discovered that a small species of Millepede was an excellent food for those little animals; they will also devour the *Polices Aquatices*, the small red worms which are found in the mud banks on the banks of the Thames, common worms, the larva of gnats, and other insects, and even butcher's meat if cut small enough.

If a sufficient quantity of the red worms which are found on the mud banks, be gathered in the month of November, and put into a large glass, with three or four inches of earth at the bottom, the Polypes may be fed in the winter; cleanse the worms before they are put in among the Polypes.

To preserve those creatures in health, it will be proper to change the water in which they are kept very frequently, and particularly after they have done eating ; the water must be poured off, the Polypes taken out, and the sides and bottom of the glass washed free from all slimy sediment. To take them out, first loosen their tails from the sides or bottom of the glass ; then take them out separately, with a quill cut in the shape of a scoop, and put them into a glass with clean water.

The power of reproduction is so great in those creatures that if a Polype is cut transversely, or longitudinally, in two or three parts, it is not destroyed ; in a little time each part will become a perfect Polype ; even a small portion of the skin will produce a new creature.

If a Polype is slit, beginning at the head, and proceeding to the middle of the body, a Polype will be formed with two heads, and will eat at the same time with both. If a Polype is slit into six or seven parts, it becomes a hydra, with six or seven heads. If they are again divided it will have twelve or fourteen. If those again be severed from the trunk, as many new ones will spring up in their place, and the heads thus deprived of the body will become new Polypes also.

Those who may wish for farther information relative to the varieties, habits, and properties of Polypes, we refer to the *Essays on the Natural History of Polypes*, by Henry Baker * ; to *Memoires pour servir à l'Histoire d'une Espece de Polypes d'Eau douce*, par M. Trembley † ; to *Lettres d'Eugene à Clarence au Sujet des Animaux*

* Lond. 1743—8.

† Leyd. 1744.

appellées Polypees ‡, and particularly to Mr. Adams's Essay on the Microscope §, in which the reader will find a circumstantial detail of the most material discoveries and experiments that have been made by different naturalists, on those singular creatures.

The instructions for their preservation as microscopic objects, as they were given by Mr. *Baker*, and since inserted in Mr. *Adams's* Essay, will be particularly useful to the early naturalist, not only so far as relates to Polypes, but as with care many animals of a similar texture may be preserved by the same means.

“ Chuse a proper Polype, and put in a small concave lens, with a drop of water ; when it is extended, and the tail fixed, pour off a little of the water, and then plunge it with the concave into some spirit of wine contained in the bowl of a large spoon ; by this it is instantly killed, the arms and body contracting more or less ; rub it gently, while in spirits, with a soft hair pencil, to cleanse it from the lice.

“ The difficulty now begins ; for the parts of the Polype, on being taken out of the spirits, immediately cling together, so that it is not practicable to extend the body, and separate the arms on the talc, without tearing them to pieces : so that the only method is, to adjust them upon the talc while in the spirits ; this may be done by slipping the talc under the body of the Polype, while it lies in the spirits, and displaying its arms thereon by the small hair pencil and a pair of nippers ; then lift the talc with the Polype upon it, out of the spirits, take hold of it with the nippers in the left hand, dip the pen-

‡ A. Straß. 1745—8.

§ Lond. 1787.

cil in the spirits with the right hand, and therewith dispose of the several parts, that they may lie in a convenient manner, at the same time brushing away any lice that may be seen upon the talc; now let it dry, which it does in a little time, and place the talc carefully in the hole of the slider. To prevent the upper talc and ring pressing on the Polype, you must cut three pieces of cork about the bigness of a pin's head, and the depth of the Polype, and fix them by gum in a triangular position, partly on the edges of the said talc, partly to the sides of the ivory hole itself; the upper talc may then be laid on these corks, and pressed down by the ring as usual."

PLANTS.

PLANTS are sometimes transmitted from one country to another, by slips or cuttings, but as those require the skilful management of the gardener during the passage, roots or seeds should always be preferred. It is, however, very difficult to lay down any precise mode of treatment that will answer for all seeds indiscriminately: some kinds keep best exposed to the air; while others are preserved by a total exclusion of it*. The seeds of parsley, lettuce, onions, &c. kept in vials hermetically sealed a twelve month, did not vegetate, while those of the same age and sort hung up in bags in a dry room, vegetated freely.

In *Ellis's* directions for bringing over seeds and plants, the necessity of giving fresh air to some seeds is clearly proved †, though it is certain

* *Miller's Gardeners Dictionary.*

† “ A gentleman going to Bencoulen in the island of Sumatra, had a mind to furnish himself with an assortment of seeds for a kitchen garden; these were accordingly packed up in boxes and casks, and stowed with the other goods in the hold of the ship.

“ When he arrived at Bencoulen, he sowed his seeds; but soon found to his great mortification that they were all spoiled, for none of them came up.

“ Convinced that it must be owing to the heat of the ship's hold, and their long confinement in putrid air, and having some occasion to return to England, he determined in his next voyage thither to pack them up in such a manner, and place them

certain that the vegetative power of many other kinds can only be preserved by a total exclusion of air, as coating them with wax or enclosing them in tin canisters, &c. ‡

Some

so as to give them as much air as he could, without the danger of exposing them to the salt water; and therefore put the smaller kinds into separate papers, and placed them among some clean straw in a small close net, and hung it up in his cabin; and the larger ones he put into boxes, stowing them where the free air could come at them, and blow through them: the effect was, that as soon as he arrived at Bencoulen he sowed them, and in a little time found, to his great satisfaction, that they grew extremely well."

‡ This method " principally consists in choosing such seeds as are perfectly sound and ripe. To prove this, we must cut open some of them to judge what situation the rest may be in, taking care to lay aside any that are outwardly defective or marked with the wounds of insects. When a proper choice of them is made, they should be wiped extremely clean to prevent any dirt or moisture being enclosed; each seed should then be rolled up carefully in a coat of soft bees-wax, half an inch thick: the deep English bees-wax is the best. When you have covered the number you intend to enclose, pour some of this bees-wax melted into a chip box of six or seven inches long, four broad, and three deep, till it is above half full; and just before it begins to harden, while it is yet fluid, put in the seeds you have rolled up in rows till the box is near full; then pour over them some more wax while it is just fluid, taking care when it is cold to stop all the cracks or chinks that may have proceeded from the shrinking of the wax, with some very soft wax; then put on the cover of the box, and keep it in as cool and airy a place as you can,

" Acorns so preserved have vegetated freely after they have been kept a whole season enclosed in wax.

" Another method that has been tried with success is, by procuring the tea-seeds in their pods or capsules, when they are brought down fresh from the tea country, at the latter end of the year, to Canton, at the time that our East-India ships are preparing to depart for Europe. The seeds then in their pods are to be put into pound or half-pound canisters made of tin and tutenague, with a double rim to the top: the inside of the canister should be first lined with silk paper, or the paper commonly used in China, and the seeds pressed down close, but not so as to be bruised. When the canister is near full to the neck, some more of the same paper must be stuffed in very close, till it is full to the top, and then the double-rimmed cover should be put on very tight. Care must be taken that the seeds are not too moist when they are put into the canister, and

Some seeds will retain their vegetative property for a considerable time if buried in a bed of earth, a foot or more below the surface § ; others may be enclosed in vials, corked and sealed with a composition of melted resin and bees-wax, and placed in casks or boxes of salt ; and the seeds of most aquatic plants should be transimitted in water.

Seeds which contain much oil, and are of a warm nature, may be generally kept for a considerable length of time without any injury ; those of parsley, carrots and parsnip, it is said, will not grow if more than a year old.

Colonel Davies has given the following useful instructions for the transmission of plants from one country to another.

that they are found and in good order. The canister then is to be kept in an airy cool place. If the ship arrives early in England, I mean in July, they may be sown with success ; the sooner it is done, the better chance we shall have of their growing. Those seeds which I have seen brought over in this manner, had shot out roots owing to the heat of the climates they had passed through, and the confined moisture ; and though not twenty out of two hundred in the canister succeeded, yet these are thought a great acquisition.

“ The smallest seeds being very liable to lose their vegetative power by long voyages through warm climates, it may be worth while to try the following experiment upon such kinds as we know for certain are found. Dip some spare pieces of cotton cloth in melted wax, and whilst it is soft, and almost cold, strew the surface of each piece over with each sort of small seed, then roll them up tight, and enclose each roll in some soft bees-wax, wrapping up each of them in a piece of paper, with the name of the seed on it.”—ELLIS'S *Directions for bringing over Seeds and Plants*.

§ Miller relates that the seeds of Corn-Sallad which had lain buried in the earth thirty-two years, when turned up to the air grew as readily as fresh seeds ; it is highly probable that they would not have kept one third of that time out of the ground.

“ With respect to shrubs and plants, I would recommend (as I have from considerable experience found) their being dug up carefully, so as to break the roots as little as possible ; when about eighteen inches, or two feet high, wash all stones and earthy particles away from the roots as clean as possible with fresh water, procure boxes of any kind of wood inch thick, thirty or thirty-six inches long, fourteen or sixteen wide, and as many deep ; bore a considerable number of holes with a large gimblet in the bottom and lid. Cover the bottom with soft long wet moss, about an inch or two thick, and lay the plants with their tops towards the ends of the box as close as possible, about two inches deep : cover them with a layer of wet moss, inch deep, and proceed with another layer of plants, and so on until the whole of the box is filled, covering the upper layer of all with wet moss in like manner. If some moss is also added to the ends of the box the better, as their being pressed close down in the box does not damage or injure them ; many by so doing may be packed in a small space. Nail on the top of the box and immerse it under water in a pond, river, or tub, for a few minutes to admit it into the moss ; it may then be kept in any damp cellar or out-house free from harm, until sent on board ship, and requires no further trouble, but once in five or six weeks to pour some fresh water on the top or bottom, through the holes, to moisten the moss within. In this manner vast quantities of scarce and valuable plants may be easily transported from one part of the globe to another. Although I have never yet made the experiment myself, I am confident that all kinds of nuts, and hard seeds, may be sent in this manner from place to place with great probability of security and success ; as the vegetative part of the seed, by being nourished by the moisture of the moss, will be surer preserved, than by any other mode I have heard of. Small seeds will do very well in dry papers, or in small bottles, mixt with dry sand that has not been

near salt-water; bulbs keep admirably well also in fresh dry sand or moss, packed in small boxes or kegs."

From countries which we are not permitted to explore, as China, Japan, &c. the curious traveller may obtain many rare plants, if he will examine the fodder that is brought down from the country, by the natives; the indefatigable *Thunberg**, who was commissioned to collect seeds and specimens of plants in Japan for the medicinal garden at Amsterdam, was prevented by the jealousy of the Japanese from herbarizing in that country for a considerable time after his arrival, but from the fodder which he examined very carefully every time it was brought down from the country for the cattle, he fortunately selected many rare and curious plants.

F E R N S.

We cannot dismiss those instructions for the preservation or transportation of seeds, without taking notice of a very interesting discovery which Mr. John Lindsay, a surgeon in Jamaica, communicated to Sir Joseph Banks, Bart. in the year 1789, relative to the germi-

* In 1780 he was appointed Professor Royal at Upsal, in the room of *Linnaeus*, the son, who was then on his travels, and died soon after. In the course of sixteen months Mr. *Thunberg* collected three hundred new species of plants; which are all included in the *Flora Japonica*; and in the supplement to the plants published by *Linnaeus* the son in 1781, there are more than nine hundred new species, which were communicated by Mr. *Thunberg* alone; a proof how inconsiderable must be our knowledge of the botanical productions of those countries before that time.

nation and raising of Ferns from the seed. We shall not presume to follow this gentleman through the whole of his very pleasing discourse, but refer our readers, if they desire a farther account, to the thirteenth article of the Linnæan Transactions, Vol. II.

Mr. Lindsay, as being an assistant to Dr. Clarke, botanist for that island, could not be ignorant of the various opinions which were entertained by botanists respecting the fructification of this tribe of plants, and of the difficulty of raising them from the seeds; having some spare time when he arrived at Jamaica which he could with propriety dedicate to a minute observance of those plants, he endeavoured to ascertain their seed; their minuteness rendered every attempt to discover them, by searching at the roots of even the smallest visible plants fruitless, he then thought of sowing the powder or dust which falls from the leaves when drying in a flower-pot, and observing their progress; to do this with care and certainty he mixed some of the powder with some of the mould it was to be sown in, and by the assistance of the microscope was soon able to distinguish the different parts of the powder, or fructification from the mould in which it was sown. He next proceeds to relate the alterations which he observed in the seeds of several species, from the first symptoms of vegetation to the expansion of the leaves, and illustrates the progress by several figures and suitable references. Engaged in the practice of medicine soon after, he thought no more of the subject, till he had the honour of a very polite letter, from Sir Joseph Banks, Bart. by which he was induced to resume his observations, and transmit his valuable discovery to England.

He says “ the seeds of Ferns may be procured with readiness and ease by taking those frondes or leaves on which the fructification is copious, fair and conspicuous ; which are of full growth, have a healthy appearance, and are more exposed to the free air than confined in the shade. These leaves, laid on clean paper in a dry place, soon shed their seed in the form of dust or fine powder, of colour varying from black or brown to yellow ; the grosser part of this powder is the empty capsules, and that very fine part which adheres close to the paper is the seed. The seeds thus procured may be sown immediately, or kept in paper in a dry place.”

He next determines, that like other vegetables, many species of Ferns requires a soil and situation peculiar to themselves ; he took equal parts of brick mould and good pit marle, at some depth* below the surface, to avoid the seeds of other plants, mixed them well together, and with this filled the flower-pot, moistened it properly, and made the surface very smooth ; he then divided it into small spaces, according to the number of the different kinds intended to be sown in it ; and lastly strewed the seeds lightly on the surface. The seeds which are sown in this manner should be placed in a heat corresponding to that of their native climate, in a place rather moist than too dry, freely open to the light and fresh air, but so shaded that the direct rays of the sun cannot reach them.

OBSERVATIONS

On the Manner of making a

H O R T U S - S I C C U S.

The Abbé Hauy, of the royal academy of sciences at Paris, in the year 1785, presented that society with the following interesting observations, relative to the preservation of dried plants.

“ Of all the productions of nature, there are none more susceptible of change than vegetables, or which require more care and attention for their preservation. Flowers, in particular, soon lose their colours in an herbal, and assume others, quite different from those bestowed on them by nature. Yellow grows pale, or becomes nearly effaced; blue or red are still more apt to fade or disappear entirely. The flowers of the Violet, the Campanula, of several species of Geranium, and a multitude of other plants which add to the ornament of the fields, and often to that even of our gardens, become, in a few days so much tarnished, that they cannot be known by any eye but that of an experienced botanist.

“ This inconvenience I have endeavoured to remedy, at least, in part; and as I found it almost impossible to fix the natural colours of plants, I attempted to discover a method of substituting artificial colours for them which might not fade, so that the flower, by preserving its bloom, and all its essential characteristics, might in some degree exhibit its natural colour. For this purpose, I painted a piece of fine paper with water colours in such a manner as to have, as much as possible, the same degree of strength as those of nature,

only a little fainter, for a reason I shall mention hereafter. When I had done this I threw the leaves into spirits of wine, where they soon lost all their colours, and were reduced to whitish transparent membranes. After having dried them thoroughly, by pressing them between two folds of a fine cloth, I laid them on the coloured paper by means of a thick varnish, which I took care to spread over the paper in order that they might adhere to it, I afterwards drew another paper, several times over the flower pressing it strongly with my hand until all the leaves were properly applied, and until the artificial colours appeared through them. In this operation the colours become a little darker ; for which reason it will be necessary to make the tints a little fainter than what they are naturally. I afterwards left the flower a few moments in a press, then, having cut the paper around it, I applied it with a dissolution of gum-arabic to the place it should occupy on the plant, which had been before fixed by means of the same dissolution to a piece of paper of a proper size.

“ It will be of great service when those flowers even are applied, which have permanent colours, such as the greater part of the wild *Ranunculuses*, to begin by cementing the flowers to a piece of paper, and to cut it round the leaves, as in the preceding case, before they are added to the plant. This operation renders them more natural, and if their position is such that they cover the leaves of the plant, which will often happen, the colour of the leaves does not injure that of the flowers, by appearing through their delicate membraness, which are in part diaphanous.

“ There are some plants, the leaves of which, on account of their thickness and spongy substance, cannot easily be dried, and which become black before their juices have been extracted by the ordinary

ordinary mode of drying. Such, among others, are those of the orchis. I have observed that by peeling off, with a pointed knife, the thin pellicle which covers the lower part of these leaves, before I cemented them to the paper, it greatly hastened their desiccation, so that it generally took place in two or three days, and even in a much shorter space of time. The leaves then preserved their verdure in a great measure, or, at least, assumed only a tint inclining a very little to yellow, without ever appearing of that black colour which indicates the last degree of decay in a species of productions the most beautiful and pleasing in nature.

“ I have submitted to the inspection of the academy the Violet, the Geranium, and the common Poppy of the fields, the artificial colours of which have preserved their lustre for many years, I have added also three species of orchis, the leaves of which still retain their freshness after being dried ten years, the summer Adonis and common Cinque Foil, &c. the natural colours of which have been preserved without any other precaution than the care I took to dry them between folds of warm paper as speedily as I possibly could, and not to expose them to the air, or to moisture.”

This method may be applied to most plants, with the greatest prospect of success; but as the time it will require to preserve only a few specimens may be more than every collector can spare, a more simple process is recommended; dry the plants between the leaves of a large book, or sheets of stout paper, and press them even in a screw-press, or let them remain under a heavy weight for some time; then spread a thin coat of gum-arabic on the paper, and display the plants thereon as smooth as possible. They should after this be covered with a thin coat of copal varnish to preserve them from the ravages of insects, or the ill effects of damp.

Plants lose all their native verdure in spirit of wine, but preserve their form perfectly well, if therefore they are preserved on account of the singular structure of any part, it is best to keep them in bottles, with either spirit of wine, rum, or brandy, &c. Spirit of wine diluted with common water will preserve the colours of some plants tolerably well.

The most interesting discourse we have met with on the preservation of vegetables, is that which Dr. Withering communicated to the Linnæan Society in December, 1794; it is inserted as the 23d article of the second volume of the Transactions of that Society. Dr. Withering has confined his discourse to the preservation of Fungi, only observing that Mosses and Lichens might be preserved in great perfection by the same methods.

He observes that acids, even those of a mineral origin, are apt to produce mouldiness; that neutral salts often destroy the texture of the plants; though perhaps a weak solution of common salt, with a sufficient quantity of spirit of wine, might be used advantageously for the preservation of Fuci, and other marine vegetables. Earthy salts seem useless, except alum, which preserves them tolerably well for a time, but at length they are apt to become mouldy.

For the preparation of the liquors No. 1 and No. 2, which he found most efficacious, he has given the following directions. No. 1. " To half a pound of vitriol of copper, called blue vitriol, reduced to powder, add a pint of cold water: stir them together for a minute, and then throw away the water: upon the remaining vitriol pour half a pint of boiling water: and stir them frequently until the liquor be nearly cool. Set it by in a warm place, for two or three days, to crystallize.

“ Take any quantity of these crystals, add to them as much hot water as will barely dissolve them, and put the solution into a vial.

“ To two or three quarts of pure spring water, put as much of this solution of blue vitriol as will give the whole a very slight bluish tinge: then add to it, rectified spirit of wine, in the proportion of a pint to a gallon: filter the liquor through blotting or cap paper, and put it into bottles for use.”

“ No. 2. Dissolve a quarter of an ounce of sugar of lead in a pint of distilled or very pure spring water, made boiling hot; add seven pints of pure cold water, and one pint of rectified spirit of wine: filter the liquor, and keep it in bottles.”

“ The above proportion of spirit of wine is sufficient for the thickest and most succulent specimens, but less will do for such as are thick and not juicy. If the spirit be sufficient to prevent mouldiness, it is enough, for more has a tendency to extract the colours.”

“ Put the specimens into wide-mouthed jars made of flint glass, and well fitted with corks: fill the jars quite full with one or other of the above liquids, so as to leave in as little air as possible: cork the jars very close, covering the corks with tin foil, or sheet lead, such as may be had from the dealers in tea, turning the edge of the lead or tin downwards so as to lap over and under the edge of the jar.

“ The dark-coloured plants are very apt to discolour the liquor, the milky ones to render it turbid, and some of the juicy ones to
excite

excite the vinous fermentation. In any of these cases the liquor must be repeatedly changed.

“ I have principally used the liquor No. 1 ; but No. 2 is best adapted to preserve some of the more tender colours, and it also keeps the texture more firm. Let the botanist however be careful not to mix the liquors, nor to change one for the other after a plant has been wetted with one of them.”

Dr. Withering in the course of this dissertation has also given some instructions for the transportation of Agarics ; his method is nearly the same as that prescribed by Colonel Davies for the transportation of shrubs and plants in general, except that he advises to put the plants and moss in layers into an earthen jar, instead of an open box ; and to pour in the liquid No. 1, as long as the layers of moss, between the plants, will continue to imbibe any ; then to stop up the mouth securely.

FINIS.